WHAT IS CLAIMED IS:

1.   A modulation method comprising the steps of:

    generating a 6-bit output code word in response to every 4-bit

5   input code word by referring to a set of encoding tables, wherein

the encoding tables contain output code words assigned to input

code words, and contain encoding-table designation information

accompanying each output code word, wherein the encoding-table

designation information designates an encoding table among the

10 encoding tables which is used next to generate an output code word

immediately following the output code word accompanied with the

encoding-table designation information;

    sequentially connecting the generated output code words into

a sequence which follows run length limiting rules; and

15   changing the run length limiting rules between RLL(1, 7) and

RLL(1, 8) in response to auxiliary information to superimpose the

auxiliary information on the sequence of the generated output code

words.

20 2.   A modulation method as recited in claim 1, wherein NRZI

conversion results of output code words in first specified one of the

encoding tables which are assigned to prescribed input code words

are opposite in polarity to NRZI conversion results of output code

words in second specified one of the encoding tables which are

25 assigned to the prescribed input code words, and further

comprising the steps of generating a first candidate current output

code word in response to a current input code word equal to one of the prescribed input code words by referring to the first specified one of the encoding tables, and generating a second candidate current output code word in response to the current input code

5   word equal to said one of the prescribed input code words by referring to the second specified one of the encoding tables, wherein a succession of a specified immediately-preceding output code word and the first candidate current output code word and also a succession of the specified immediately-preceding output

10   code word and the second candidate current output code follow the run length limiting rules.

3.   A modulation method as recited in claim 2, further comprising the step of selecting one from the first and second

15   candidate current output code words as a final current output code word.

4.   A modulation method as recited in claim 2, further comprising the steps of:

20   calculating a first CDS of the first candidate current output code word;

updating a first DSV of the first candidate current output code word and previous final output code words in response to the first CDS;

25   calculating a second CDS of the second candidate current output code word;

updating a second DSV of the second candidate current output code word and previous final output code words in response to the second CDS;

determining which of an absolute value of the first DSV and an

5 absolute value of the second DSV is smaller; and

selecting one from the first and second candidate current output code words which corresponds to the smaller DSV absolute value as a final current output code word.

10 5.   A modulation method as recited in claim 1, further comprising the steps of:

predicting repetition of a minimum run length at least a predetermined number of times in the sequence of the generated output code words; and

15 when the repetition of the minimum run length is predicted, changing an output code word causing the repetition to prevent the repetition of the minimum run length from occurring in the sequence of the generated output code words.

20 6.   A modulation apparatus comprising:

means for generating a 6-bit output code word in response to every 4-bit input code word by referring to a set of encoding tables, wherein the encoding tables contain output code words assigned to input code words, and contain encoding-table designation

25 information accompanying each output code word, wherein the encoding-table designation information designates an encoding table

among the encoding tables which is used next to generate an output

code word immediately following the output code word

accompanied with the encoding-table designation information;

means for sequentially connecting the generated output code

5   words into a sequence which follows run length limiting rules; and

means for changing the run length limiting rules between

RLL(1, 7) and RLL(1, 8) in response to auxiliary information to

superimpose the auxiliary information on the sequence of the

generated output code words.

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7.   A modulation apparatus as recited in claim 6, wherein NRZI

conversion results of output code words in first specified one of the

encoding tables which are assigned to prescribed input code words

are opposite in polarity to NRZI conversion results of output code

15   words in second specified one of the encoding tables which are

assigned to the prescribed input code words, and further

comprising means for generating a first candidate current output

code word in response to a current input code word equal to one of

the prescribed input code words by referring to the first specified

20   one of the encoding tables, and means for generating a second

candidate current output code word in response to the current

input code word equal to said one of the prescribed input code

words by referring to the second specified one of the encoding

tables, wherein a succession of a specified immediately-preceding

25   output code word and the first candidate current output code word

and also a succession of the specified immediately-preceding output

code word and the second candidate current output code follow the run length limiting rules.

8.   A modulation apparatus as recited in claim 7, further
5   comprising means for selecting one from the first and second candidate current output code words as a final current output code word.

9.   A modulation apparatus as recited in claim 7, further
10   comprising:

means for calculating a first CDS of the first candidate current output code word;

means for updating a first DSV of the first candidate current output code word and previous final output code words in response
15   to the first CDS;

means for calculating a second CDS of the second candidate current output code word;

means for updating a second DSV of the second candidate current output code word and previous final output code words in
20   response to the second CDS;

means for determining which of an absolute value of the first DSV and an absolute value of the second DSV is smaller; and

means for selecting one from the first and second candidate current output code words which corresponds to the smaller DSV
25   absolute value as a final current output code word.

10. A modulation apparatus as recited in claim 6, further comprising:

means for predicting repetition of a minimum run length at least a predetermined number of times in the sequence of the

5 generated output code words; and

means for, when the repetition of the minimum run length is predicted, changing an output code word causing the repetition to prevent the repetition of the minimum run length from occurring in the sequence of the generated output code words.

10

11. A demodulation method of demodulating a sequence of 6-bit code words which is generated by the modulation method in claim 1, the demodulation method comprising the steps of:

recovering encoding-table designation information from the

15 code-word sequence, the encoding-table designation information representing which of encoding tables has been used in generating a code word immediately following a code word of interest; and

demodulating the code word of interest into an original code word by referring to a decoding table in response to the recovered

20 encoding-table designation information.

12. A demodulation method as recited in claim 11, further comprising the steps of:

detecting whether the code-word sequence corresponds to

25 (1, 7)RLL or (1, 8)RLL; and

reproducing auxiliary information in response to a result of

detecting whether the code-word sequence corresponds to (1, 7)RLL or (1, 8)RLL.

13. A demodulation apparatus for demodulating a sequence of 6-bit code words which is generated by the modulation apparatus in claim 6, the demodulation apparatus comprising:

means for recovering encoding-table designation information from the code-word sequence, the encoding-table designation information representing which of encoding tables has been used in generating a code word immediately following a code word of interest; and

means for demodulating the code word of interest into an original code word by referring to a decoding table in response to the recovered encoding-table designation information.

14. A demodulation apparatus as recited in claim 13, further comprising:

means for detecting whether the code-word sequence corresponds to (1, 7)RLL or (1, 8)RLL; and

means for reproducing auxiliary information in response to a result of detecting whether the code-word sequence corresponds to (1, 7)RLL or (1, 8)RLL.

15. An information recording medium storing a sequence of code words which is generated by the modulation apparatus in claim 6.

16.   An information transmission method of transmitting a sequence of code words which is generated by the modulation method in claim 1.

5   17.   An information transmission apparatus for transmitting a sequence of code words which is generated by the modulation apparatus in claim 6.

18.   A method of recording auxiliary information, comprising the

10   steps of:

generating a 6-bit output code word in response to every 4-bit input code word by referring to a set of encoding tables, wherein the encoding tables contain output code words assigned to input code words, and contain encoding-table designation information

15   accompanying each output code word, wherein the encoding-table designation information designates an encoding table among the encoding tables which is used next to generate an output code word immediately following the output code word accompanied with the encoding-table designation information;

20   sequentially connecting the generated output code words into a sequence which follows run length limiting rules; and

changing the run length limiting rules between RLL(1, 7) and RLL(1, 8) in response to auxiliary information to superimpose the auxiliary information on the sequence of the generated output code

25   words;

wherein the auxiliary information contains at least one of 1) an

information piece about an encryption key, 2) an information piece being a base of an encryption key, 3) a designating information piece for identifying an encryption key, 4) a designating information piece for identifying a base of an encryption key, 5) an information piece

5   about a region or regions corresponding to one or more countries, one or more zones, or one or more spaces, 6) an information piece about identification of an individual, 7) an information piece about identification of a group of persons, 8) an information piece about a rating, 9) an information piece about identification of an apparatus

10   maker or a device maker, 10) an information piece about identification of a contents provider, 11) an information piece about time, 12) an information piece about contents authors, 13) an information piece about identification of a reproducing apparatus or a reproducing device, 14) an information piece about identification

15   of a connection apparatus or a connection device, 15) an information piece about identification of a medium on which contents information is recorded, 16) an information piece about identification of contents information, 17) an information piece about accounting, 18) an information piece about playback control,

20   19) an information piece about an address to be accessed, 20) an information piece about recording control, 21) an information piece about a URL address related to contents information, 22) an information piece representing characters, 23) an information piece representing an auxiliary picture, 24) an information piece about

25   audio, 25) an information piece about a copyright, and 26) an information piece about legitimacy of a recording medium storing

data.

19.   A method as recited in claim 18, wherein NRZI conversion results of output code words in first specified one of the encoding tables which are assigned to prescribed input code words are opposite in polarity to NRZI conversion results of output code words in second specified one of the encoding tables which are assigned to the prescribed input code words, and further comprising the steps of generating a first candidate current output code word in response to a current input code word equal to one of the prescribed input code words by referring to the first specified one of the encoding tables, and generating a second candidate current output code word in response to the current input code word equal to said one of the prescribed input code words by referring to the second specified one of the encoding tables, wherein a succession of a specified immediately-preceding output code word and the first candidate current output code word and also a succession of the specified immediately-preceding output code word and the second candidate current output code follow the run length limiting rules.

20.   A method as recited in claim 19, further comprising the step of selecting one from the first and second candidate current output code words as a final current output code word.

21.   A method as recited in claim 19, further comprising the steps of:

calculating a first CDS of the first candidate current output code word;

updating a first DSV of the first candidate current output code word and previous final output code words in response to the first

5   CDS;

calculating a second CDS of the second candidate current output code word;

updating a second DSV of the second candidate current output code word and previous final output code words in response to the

10   second CDS;

determining which of an absolute value of the first DSV and an absolute value of the second DSV is smaller; and

selecting one from the first and second candidate current output code words which corresponds to the smaller DSV absolute

15   value as a final current output code word.

22.   A method as recited in claim 18, further comprising the steps of:

predicting repetition of a minimum run length at least a

20   predetermined number of times in the sequence of the generated output code words; and

when the repetition of the minimum run length is predicted, changing an output code word causing the repetition to prevent the repetition of the minimum run length from occurring in the

25   sequence of the generated output code words.

23.   An apparatus for recording auxiliary information, comprising:

means for generating a 6-bit output code word in response to every 4-bit input code word by referring to a set of encoding tables, wherein the encoding tables contain output code words assigned to

5   input code words, and contain encoding-table designation information accompanying each output code word, wherein the encoding-table designation information designates an encoding table among the encoding tables which is used next to generate an output code word immediately following the output code word

10   accompanied with the encoding-table designation information;

means for sequentially connecting the generated output code words into a sequence which follows run length limiting rules; and

means for changing the run length limiting rules between RLL(1, 7) and RLL(1, 8) in response to auxiliary information to

15   superimpose the auxiliary information on the sequence of the generated output code words;

wherein the auxiliary information contains at least one of 1) an information piece about an encryption key, 2) an information piece being a base of an encryption key, 3) a designating information piece

20   for identifying an encryption key, 4) a designating information piece for identifying a base of an encryption key, 5) an information piece about a region or regions corresponding to one or more countries, one or more zones, or one or more spaces, 6) an information piece about identification of an individual, 7) an information piece about

25   identification of a group of persons, 8) an information piece about a rating, 9) an information piece about identification of an apparatus

maker or a device maker, 10) an information piece about identification of a contents provider, 11) an information piece about time, 12) an information piece about contents authors, 13) an information piece about identification of a reproducing apparatus or a reproducing device, 14) an information piece about identification of a connection apparatus or a connection device, 15) an information piece about identification of a medium on which contents information is recorded, 16) an information piece about identification of contents information, 17) an information piece about accounting, 18) an information piece about playback control, 19) an information piece about an address to be accessed, 20) an information piece about recording control, 21) an information piece about a URL address related to contents information, 22) an information piece representing characters, 23) an information piece representing an auxiliary picture, 24) an information piece about audio, 25) an information piece about a copyright, and 26) an information piece about legitimacy of a recording medium storing data.

24. An apparatus as recited in claim 23, wherein NRZI conversion results of output code words in first specified one of the encoding tables which are assigned to prescribed input code words are opposite in polarity to NRZI conversion results of output code words in second specified one of the encoding tables which are assigned to the prescribed input code words, and further comprising means for generating a first candidate current output code word in response

to a current input code word equal to one of the prescribed input code words by referring to the first specified one of the encoding tables, and means for generating a second candidate current output code word in response to the current input code word equal to said

5 one of the prescribed input code words by referring to the second specified one of the encoding tables, wherein a succession of a specified immediately-preceding output code word and the first candidate current output code word and also a succession of the specified immediately-preceding output code word and the second

10 candidate current output code follow the run length limiting rules.

25.   An apparatus as recited in claim 24, further comprising means for selecting one from the first and second candidate current output code words as a final current output code word.

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26.   An apparatus as recited in claim 24, further comprising:

means for calculating a first CDS of the first candidate current output code word;

means for updating a first DSV of the first candidate current

20 output code word and previous final output code words in response to the first CDS;

means for calculating a second CDS of the second candidate current output code word;

means for updating a second DSV of the second candidate

25 current output code word and previous final output code words in response to the second CDS;

means for determining which of an absolute value of the first DSV and an absolute value of the second DSV is smaller; and

means for selecting one from the first and second candidate current output code words which corresponds to the smaller DSV
5   absolute value as a final current output code word.

27.   An apparatus as recited in claim 23, further comprising:

means for predicting repetition of a minimum run length at least a predetermined number of times in the sequence of the
10   generated output code words; and

means for, when the repetition of the minimum run length is predicted, changing an output code word causing the repetition to prevent the repetition of the minimum run length from occurring in the sequence of the generated output code words.
15

28.   A method of reproducing an auxiliary information from a sequence of 6-bit code words which is generated by the recording method in claim 18, the reproducing method comprising the steps of:
20   recovering encoding-table designation information from the code-word sequence, the encoding-table designation information representing which of encoding tables has been used in generating a code word immediately following a code word of interest; and

demodulating the code word of interest into an original code
25   word by referring to a decoding table in response to the recovered encoding-table designation information.

29. A method as recited in claim 28, further comprising the steps of:

detecting whether the code-word sequence corresponds to

5 (1, 7)RLL or (1, 8)RLL; and

reproducing auxiliary information in response to a result of detecting whether the code-word sequence corresponds to (1, 7)RLL or (1, 8)RLL.

10 30. An apparatus for reproducing an auxiliary information from a sequence of 6-bit code words which is generated by the recording apparatus in claim 23, the reproducing apparatus comprising:

means for recovering encoding-table designation information from the code-word sequence, the encoding-table designation

15 information representing which of encoding tables has been used in generating a code word immediately following a code word of interest; and

means for demodulating the code word of interest into an original code word by referring to a decoding table in response to

20 the recovered encoding-table designation information.

31. An apparatus as recited in claim 30, further comprising:

means for detecting whether the code-word sequence corresponds to (1, 7)RLL or (1, 8)RLL; and

25 means for reproducing auxiliary information in response to a result of detecting whether the code-word sequence corresponds to

(1, 7)RLL or (1, 8)RLL.

32. A recording medium storing a sequence of code words which is generated by the recording apparatus in claim 23.

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33. A transmission apparatus for transmitting a sequence of code words which is generated by the recording apparatus in claim 23.

34. A transmission method of transmitting a sequence of code 10 words which is generated by the recording method in claim 18.

35. A method of reproducing data from a sequence of 6-bit code words which is generated by the recording method in claim 18, the reproducing method comprising the steps of:

15 recovering encoding-state information from the code-word sequence, the encoding-state information representing which of encoding tables has been used in generating a code word immediately following a code word of interest;

demodulating the code word of interest into an original code 20 word by referring to a decoding table in response to the generated encoding-state information;

reproducing auxiliary information from the code-word sequence; and

executing, in response to the reproduced auxiliary 25 information, at least one of 1) generation of an encryption key, 2) identification of an encryption key, 3) identification of a base of an

encryption key, 4) control of playback on the basis of a region, 5) control of playback on the basis of a rating, 6) control of recording and playback on the basis of identification information, 7) control of recording and playback on the basis of recording and playback

5   control information, 8) decision about an address to be accessed, 9) access to a URL address related to contents information, 10) playback of character information, 11) playback of an auxiliary-picture information, 12) playback of audio visual information, and 13) authentication as to whether or not a recording medium is

10 legitimate.

36.   A method as recited in claim 35, wherein the auxiliary-information reproducing step comprises the steps of:

detecting whether the code-word sequence corresponds to

15 (1, 7)RLL or (1, 8)RLL; and

reproducing the auxiliary information in response to a result of detecting whether the code-word sequence corresponds to (1, 7)RLL or (1, 8)RLL.

20 37.   An apparatus for reproducing data from a sequence of 6-bit code words which is generated by the recording apparatus in claim 23, the reproducing apparatus comprising:

means for recovering encoding-state information from the code-word sequence, the encoding-state information representing

25 which of encoding tables has been used in generating a code word immediately following a code word of interest;

means for demodulating the code word of interest into an original code word by referring to a decoding table in response to the generated encoding-state information;

means for reproducing auxiliary information from the code-word sequence; and

means for executing, in response to the reproduced auxiliary information, at least one of 1) generation of an encryption key, 2) identification of an encryption key, 3) identification of a base of an encryption key, 4) control of playback on the basis of a region, 5) control of playback on the basis of a rating, 6) control of recording and playback on the basis of identification information, 7) control of recording and playback on the basis of recording and playback control information, 8) decision about an address to be accessed, 9) access to a URL address related to contents information, 10) playback of character information, 11) playback of an auxiliary-picture information, 12) playback of audio visual information, and 13) authentication as to whether or not a recording medium is legitimate.

38.   An apparatus as recited in claim 37, wherein the auxiliary-information reproducing means comprises:

means for detecting whether the code-word sequence corresponds to (1, 7)RLL or (1, 8)RLL; and

means for reproducing the auxiliary information in response to a result of detecting whether the code-word sequence corresponds to (1, 7)RLL or (1, 8)RLL.

39.   A modulation apparatus comprising:

means for generating a final 6-bit output code word in response to every 4-bit input code word by referring to a set of

5   encoding tables, wherein the encoding tables contain output code words assigned to input code words, and contain encoding-table designation information accompanying each output code word, wherein the encoding-table designation information designates an encoding table among the encoding tables which is used next to

10   generate an output code word immediately following the output code word accompanied with the encoding-table designation information;

means for generating a first candidate current output code word in response to a current input code word equal to one of

15   prescribed input code words by referring to one of first and second specified encoding tables among the encoding tables which is designated by encoding-table designation information accompanying an immediately-preceding final output code word;

means for generating a second candidate current output code

20   word in response to the current input code word equal to said one of the prescribed input code words by referring to the other of the first and second specified encoding tables under conditions where a succession of the second candidate current output code word and the immediately-preceding final output code word follows a run

25   length limiting rule;

means for calculating a first DSV from the first candidate

current output code word and previous final output code words;

means for calculating a second DSV from the second candidate current output code word and previous final output code words;

5   means for determining which of an absolute value of the first DSV and an absolute value of the second DSV is smaller;

means for selecting one from the first and second candidate current output code words which corresponds to the smaller DSV absolute value as a final current output code word; and

10   means for changing the run length limiting rule to change a maximum run length in a sequence of final output code words in response to auxiliary information to superimpose the auxiliary information on the sequence of the final output code words.

15   40.   A modulation apparatus as recited in claim 39, wherein the sequence of the final output code words represents encryption-resultant main information, and the auxiliary information contains an information piece for decrypting the encryption-resultant main information.

20

41.   A modulation apparatus as recited in claim 39, wherein the sequence of the final output code words represents scrambling-resultant main information, and the auxiliary information contains an information piece for descrambling the scrambling-resultant

25   main information.

42.   A demodulation apparatus comprising:

means for recovering encoding-state information from a sequence of code words, the encoding-state information representing which of encoding tables has been used in generating a

5   code word immediately following every code word of interest;

means for demodulating the code word of interest into an original code word by referring to a decoding table in response to the generated encoding-state information;

means for detecting a frequency of occurrence of a specified

10   run length in the sequence of code words; and

means for reproducing auxiliary information from the sequence of code words in response to the detected occurrence frequency.

15   43.   A demodulation apparatus as recited in claim 42, further comprising means for decrypting encryption-resultant main information represented by a sequence of original code words in response to the reproduced auxiliary information.

20   44.   A demodulation apparatus as recited in claim 42, further comprising means for descrambling scrambling-resultant main information represented by a sequence of original code words in response to the reproduced auxiliary information.